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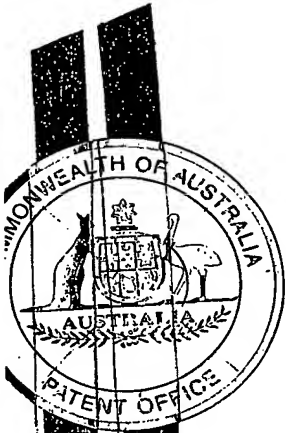
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SALES hereby certify that annexed is a true copy of the Provisional specification
in connection with Application No. 2003902257 for a patent by HEAD
ELECTRICAL INTERNATIONAL PTY LTD as filed on 09 May 2003.

WITNESS my hand this
Second day of February 2004



JULIE BILLINGSLEY
TEAM LEADER EXAMINATION
SUPPORT AND SALES



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PROVISIONAL SPECIFICATION

Applicant(s):

HEAD ELECTRICAL INTERNATIONAL PTY LTD
A.C.N. 093 143 027

Invention Title:

AN ELECTRICAL CONNECTION DEVICE

The invention is described in the following statement:

IP Australia

Documents were received on:

09 MAY 2003

Batch No:

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Sydney

AN ELECTRICAL CONNECTION DEVICE

Field of the Invention

The present invention broadly relates to an
5 electrical connection device for a machine cable.
Throughout this specification the term "machine cable" is
used for any machine, reeling or trailing cable. The term
"connector" is used for any plug, lug, electrical adaptor,
coupler or receptacle.

10

Background of the Invention

Machine cables are typically used to provide an
electrical connection for mobile electrical machines. For
example, in the mining or petroleum industry often large
15 electrical machinery is used and each machine cable may
have to provide power in the order of a few hundred
kilowatts. Typically such power is delivered with a
voltage of one or more kilovolts. The cables usually
comprise a plurality of cores and are connected using
20 connectors having sockets and pins.

Figure 1 shows a cross-sectional representation of a
device for connecting a socket of a connector with a core
of such a machine cable. The Figure shows the socket 10
arranged to receive a pin (not shown). The Figure also
25 shows a thimble 12 which has an open end-portion 13
arranged to receive the core of the machine cable. Fingers
of the socket 10 are biased by spring 15 so that an
electrical connection with the pin may be achieved.
However, the biasing force of the spring 15 may decay over
30 time and it may be necessary to replace the spring 15
and/or the socket 10 from time to time. For this purpose
the socket is realisable connected to the thimble 12. The
thimble 12 has a threaded portion 14 and the socket 10 has

a bore 16. The threaded portion 14 and the bore 16 are arranged to receive screw 18 which engages socket 10 and thimble 12 via intermediate part 11. To reduce the likelihood that the screw 18 may loosen over time, the screw 18 is inserted with a spring washer (not shown). Socket 10 and thimble 12 have matching conical contact surfaces that match those of intermediate part 11.

Figure 2 shows a variation of the device shown in Figure 1. In this case contact surfaces of socket 20 and thimble 22 do not match when the device is disassembled. However, when the screw 18 is inserted into the bore 24 of the socket 20 and received by the threaded portion 26 of the thimble 22, the contact surface of the socket 20 is bent towards the contact surface of the thimble 22.

Both prior art devices have the disadvantage that the screw has to be relatively small as the screw head is positioned within the socket. However, the relatively small screw often does not provide sufficient strength for the connection of the socket with the thimble. Further, the contact surfaces are relatively small and the additional pathway that is provided for the current through the screw itself is often not satisfactory. The current has to pass through up to three interfaces, (between socket, intermediate part and thimble or, alternatively, between socket and spring washer, between spring washer and screw head and between the thread of screw and the thread of bore) and contact potentials, corrosion and contamination may result in contact resistivity at every interface. Further, the screw itself may not have satisfying electrical characteristics.

Summary of the Invention

The present invention provides an electrical

connection device for connecting a core of a machine cable to a contact of a connector, the device comprising:

- a first part including a contact and having a first locking surface and
- 5 • a second part including a means for connecting the core of the machine cable and having a second locking surface,

wherein the first locking surface and the second locking surface are arranged to inter-lock with each other and an
10 electrical connection is established between the core and the contact when the surfaces are interlocked.

An advantage of the present invention is that the first part and the second part can be held together
15 without any additional part which makes the assembling of the device relatively easy. Further, the assembled device may only have one interface which is of advantage for electrical properties of the device.

20 Preferred Features of the Invention

The contact may be a socket. Alternatively, the contact may be a pin.

In a preferred embodiment of the invention, the first locking surface comprises a first threaded portion and the
25 second locking surface comprises a second threaded portion arranged to receive the first threaded portion. For example, the first threaded portion may be a cylindrical portion having an outer thread and the second threaded portion may be a complimentary threaded bore arranged to
30 be interlocked with the threaded cylindrical portion. Alternatively, the second threaded portion may be a cylindrical portion having an outer thread and the first threaded portion may be a complimentary threaded bore

arranged to be interlocked with the threaded cylindrical portion.

An advantage of this preferred embodiment of the invention is that the threaded cylindrical portion and the respective threaded bore may be larger in diameter and consequently stronger than those of prior art devices as there is no need to locate a screw head within another part which is a requirement in the prior art (prior art devices are shown in Figures 1 and 2). As the threaded cylindrical portion and the respective threaded bore may be larger than in that of the screw and the respective receiving thread of the prior art devices, the electrical contact may also be improved.

The first and the second parts may also comprise first and second contact surfaces that are arranged to be in electrical contact when the locking surfaces are interlocked. The first and second contact surfaces preferably are arranged so that the first and second contact surface scrape over each other when the first and the second locking surfaces are interlocked. For example, if the threaded cylindrical portion is screwed into the threaded bore, the first and second contact surfaces may be arranged so that they eventually scrape over each other whereby the contact surfaces may be cleaned and seated onto each other and therefore a better electrical contact may be established. The threaded cylindrical portion may have a conical tip that forms the first contact surface. A respective conical extension of the threaded bore may form the second contact surface arranged to be in electrical contact with the first contact surface. The first and the second contact surface may have matching profiles. The conical tip may also be curved and arranged for contact with the conical extension of the threaded bore within a

ring-like zone near the apex of the curvature.

Alternatively, the conical extension of the threaded bore may be curved inwardly and arranged for contact with the conical tip within a ring-like zone near the apex of the curvature. As a further alternative, the conical extension of the threaded bore and the conical tip may have curved surfaces with matching profiles.

Brief Description of the Drawings

10 Figure 1 shows a cross-sectional representation of a device for connecting a socket of a connector with a core of the machine cable (prior art),

 Figure 2 shows a cross-sectional representation of another device for connecting a socket of a connector with
15 a core of the machine cable (prior art),

 Figure 3 shows a plug according to a preferred embodiment of the invention,

 Figure 4 shows an electrical connection device according to another preferred embodiment of the present
20 invention,

 Figure 5 shows an electrical connection device according to a further preferred embodiment of the present invention, and

 Figures 6 (a) and (b) show details of the electrical
25 connection device according to yet another preferred embodiment of the present invention.

Detailed Description of Preferred Embodiments

 Referring to Figure 3, a plug incorporating an
30 electrical connection device according to a preferred embodiment of the invention is now described. The plug 28 comprises a socket 32 and a thimble 31. The thimble 31 is connected to a core 33 of a machine cable 37. The socket

32. is arranged to receive a pin (not shown) and has a threaded cylindrical portion that is inter-locked with a threaded bore of the thimble 31.

The plug 28 comprises a body 29 that is of substantially cylindrical shape and an outer shell 30 composed of metallic and/or insulating material(s). The plug 28 has an end-face 38 that has three apertures that are defined by nuts such as nuts 34 and 35. From each aperture an insulating sleeve 36 projects inwardly. Thimble 31 has a key (not shown) and sleeve 36 has a corresponding key way (not shown) arranged so that rotation of the thimble 31 in the sleeve 36 can be avoided whereby screwing of the socket 32 into the thimble 31 is simplified. Alternatively, the sleeve 36 may have a key and the thimble 31 may have a corresponding key way arranged so that rotation of the thimble 31 is avoided when the socket 32 is screwed into the thimble 31.

Referring now to Figure 4, the electrical connection device 40 comprising a socket 42 and a thimble 44 is described in more detail. The socket 42 is arranged to receive a pin (not shown) and the thimble 44 comprises a plurality of recesses 45 arranged to be connected to individual branches of a core of a machine cable (not shown). The socket 42 has a first locking surface which has the form of cylindrical portion 46 having an outer thread. The thimble 44 comprises a complimentary threaded bore 48 arranged to receive the cylindrical threaded portion 46. The outer diameter of the cylindrical threaded portion 46 is relatively large compared with the outer diameter of the socket and it therefore is possible to achieve a relative strong inter-locking of the threaded cylindrical portion with the threaded bore.

The socket 42 has a contact surface 50 and the

thimble 44 has a matching contact surface 52. In this example the contact surface 50 is provided in form of a conical tip of the threaded cylindrical portion 46. The thimble 44 has a respective conical extension which
5 provides the contact surface 52 arranged to be in electrical contact with the conical contact surface 50. The contact surface 50 and the contact surface 52 have matching profiles.

Figure 5 shows a variation 59 of the device shown in
10 Figure 4 comprising a pin 60 instead of the socket in the device shown in Figure 4. The pin 60 is arranged to receive a socket (not shown) and is interlocked with the thimble 44 in the same way as the socket 42 shown in Figure 4.

15 It will be appreciated that the socket 42 of the device 40 shown in Figure 4 and the pin 60 of the device 59 shown in Figure 5 can be exchanged. Therefore, a connector such as a plug or receptacle incorporating device 40 and/or 59 shown has the advantage of greater
20 flexibility compared with prior art devices where pins and sockets are not exchangeable (see Figures 1 and 2).

Referring now to Figure 6 (a), the electrical connection device is now described in further detail. Figure 6 (a) shows a portion of a socket 61 and a portion
25 of a thimble 62 interlocked with the socket 61. In this embodiment, the socket 61 has a cylindrical portion 64 with outer thread. The cylindrical portion 64 has a conical extension 66 which provides a contact surface 68. The thimble 62 has a threaded bore 70 that has a contact
30 surface 72 in form of a conical extension shaped complimentary to the conical extension 66 of the cylindrical portion 64. If the threaded cylindrical portion 64 is screwed into the threaded bore 70, the

conical extension 66 scrapes over the conical contact surface 72 when the socket 61 is interlocked with the thimble 62 whereby the contact surfaces are cleaned and therefore a better electrical contact may be established.

5 Referring now to Figure 6 (b), a variation of the electrical connection device is now described. In this case the socket 80 has a conical contact surface 82 that is curved. The area in which electrical contact between the contact surface 82 and the contact surface 72 of the
10 thimble 62 is near within a ring-like zone near the apex of the curvature and may be smaller than that of the device shown in Figure 6 (a). However, the curved conical contact surface profile 82 may have other advantages such as progressively cleaning (scraping) the contact surface
15 72 of the thimble 62 when the socket 80 is being engaged with the thimble 62.

 Although the invention has been described with reference to particular examples, it will be appreciated by those skilled in the art that the invention may be
20 embodied in many other forms. For example, the thimble may have a threaded cylindrical portion and the socket may have a threaded bore arranged to receive the threaded cylindrical portion.

The Claims defining the Invention are as Follows:

1. An electrical connection device for connecting a core of a machine cable to a contact of a connector, the device
5 comprising:
- a first part including a contact and having a first locking surface and
 - a second part including a means for connecting the core of the machine cable and having a second locking
10 surface,
- wherein the first locking surface and the second locking surface are arranged to inter-lock with each other and an electrical connection is established between the core and the contact when the surfaces are interlocked.
- 15
2. The electrical connection device as claimed in claim 1 wherein the contact is a socket.
3. The electrical connection device as claimed in claim
20 1 or 2 wherein the contact is a pin.
4. The electrical connection device as claimed in any one of the preceding claims wherein the first locking surface comprises a first threaded portion and the second
25 locking surface comprises a second threaded portion arranged to receive the first threaded portion.
5. The electrical connection device as claimed in claim 4 wherein the first threaded portion is a cylindrical
30 portion having an outer thread and the second threaded portion is a complimentary threaded bore arranged to receive the cylindrical portion.

6. The electrical connection device as claimed in claim 4 wherein the second threaded portion is a cylindrical portion having an outer thread and the first threaded portion is a complimentary threaded bore arranged to
5 receive the cylindrical portion.

7. The electrical connection device as claimed in any one of the preceding claims wherein the first and the second parts comprise first and second contact surfaces
10 that are arranged to be in electrical contact when the locking surfaces are interlocked.

8. The electrical connection device as claimed in claim 7 when dependent on claim 5 or 6 wherein the threaded
15 cylindrical portion has a conical tip that forms the first contact surface and a respective conical extension of the threaded bore forms the second contact surface arranged to be in electrical contact with the first contact surface.

9. The electrical connection device as claimed in claim 8 wherein the first and second contact surfaces are arranged so that the first and second contact surface
20 scrape over each other when the first and the second locking surfaces interlock.

25

10. The electrical connection device as claimed in any one of claim 7 to 9 wherein the first and the second contact surface have matching profiles.

30 11. The electrical connection device as claimed in claim 8 or 9 wherein the conical tip is curved and arranged for contact with the conical extension of the threaded bore within a ring-like zone near the apex of the curvature.

12. The electrical connection device as claimed in claim
8 or 9 wherein the conical extension of the threaded bore
is curved inwardly and arranged for contact with the
5 conical tip within a ring-like zone near the apex of the
curvature.

13. The electrical connection device as claimed in claim
8 or 9 wherein the conical extension of the threaded bore
10 and the conical tip have curved surfaces with matching
profiles.

DATED this 9th day of May 2003

HEAD ELECTRICAL INTERNATIONAL PTY LTD

15 By their Patent Attorneys

GRIFFITH HACK

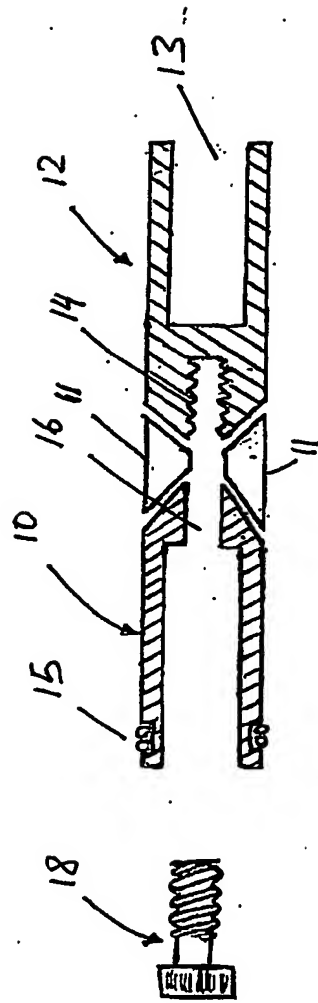


FIG. 1

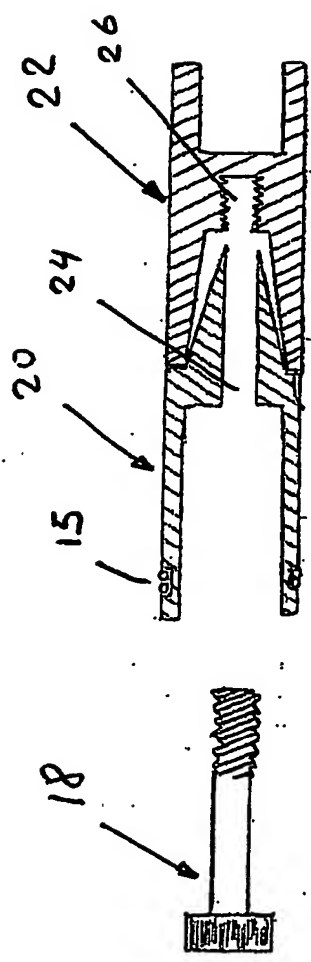


FIG. 2

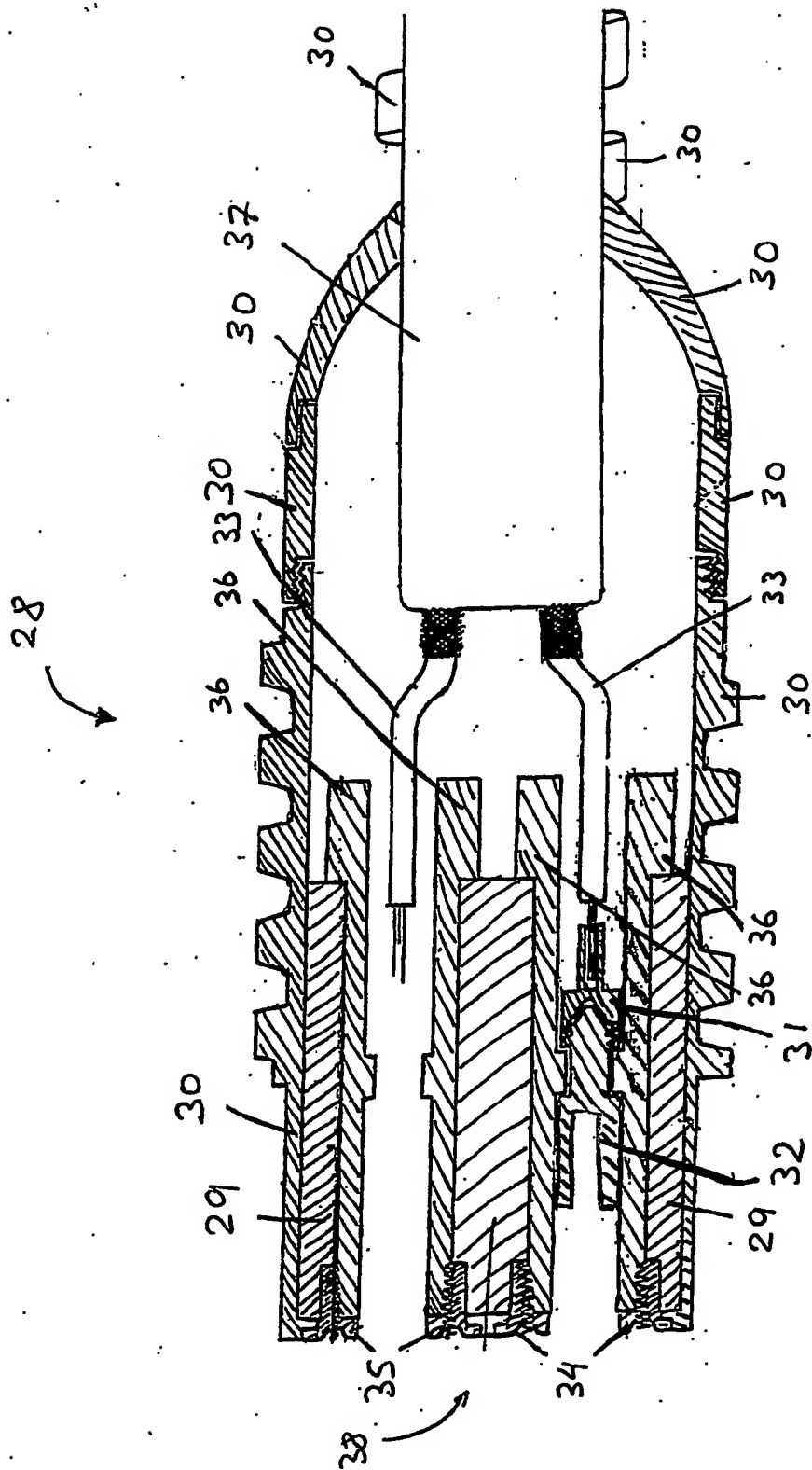


FIG. 3

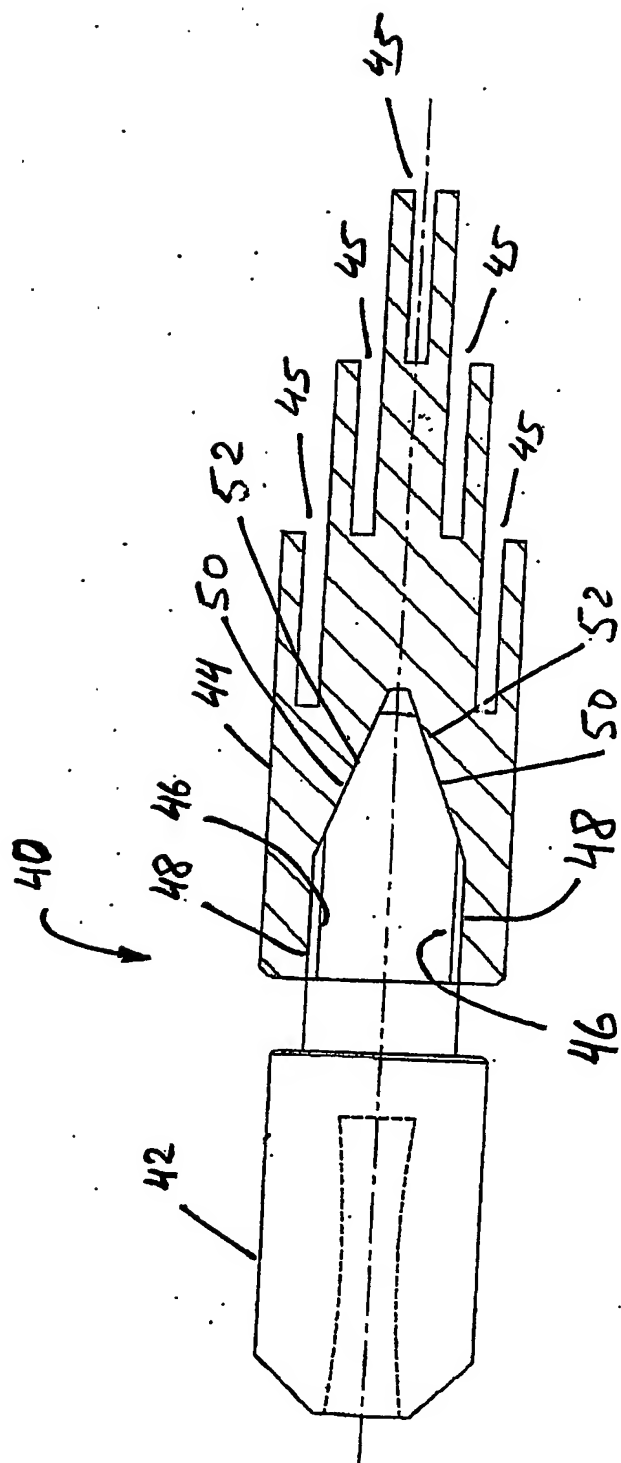
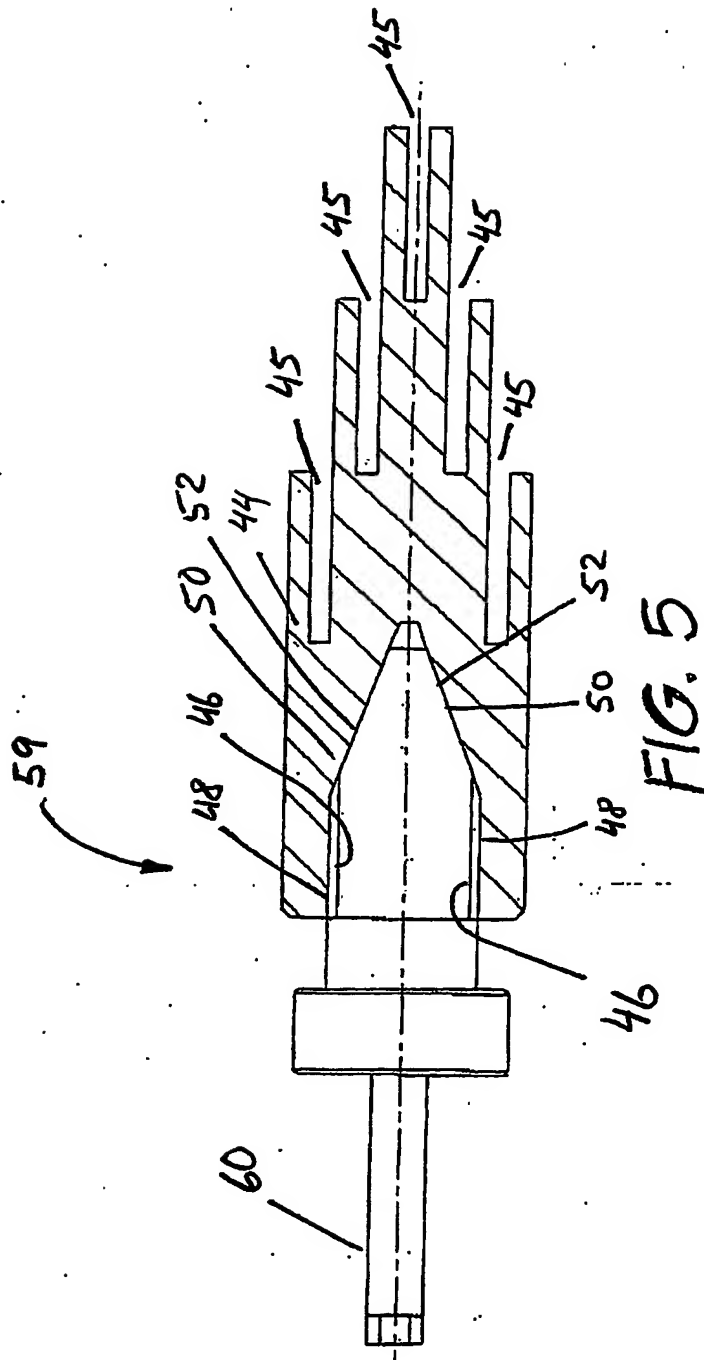


FIG. 4



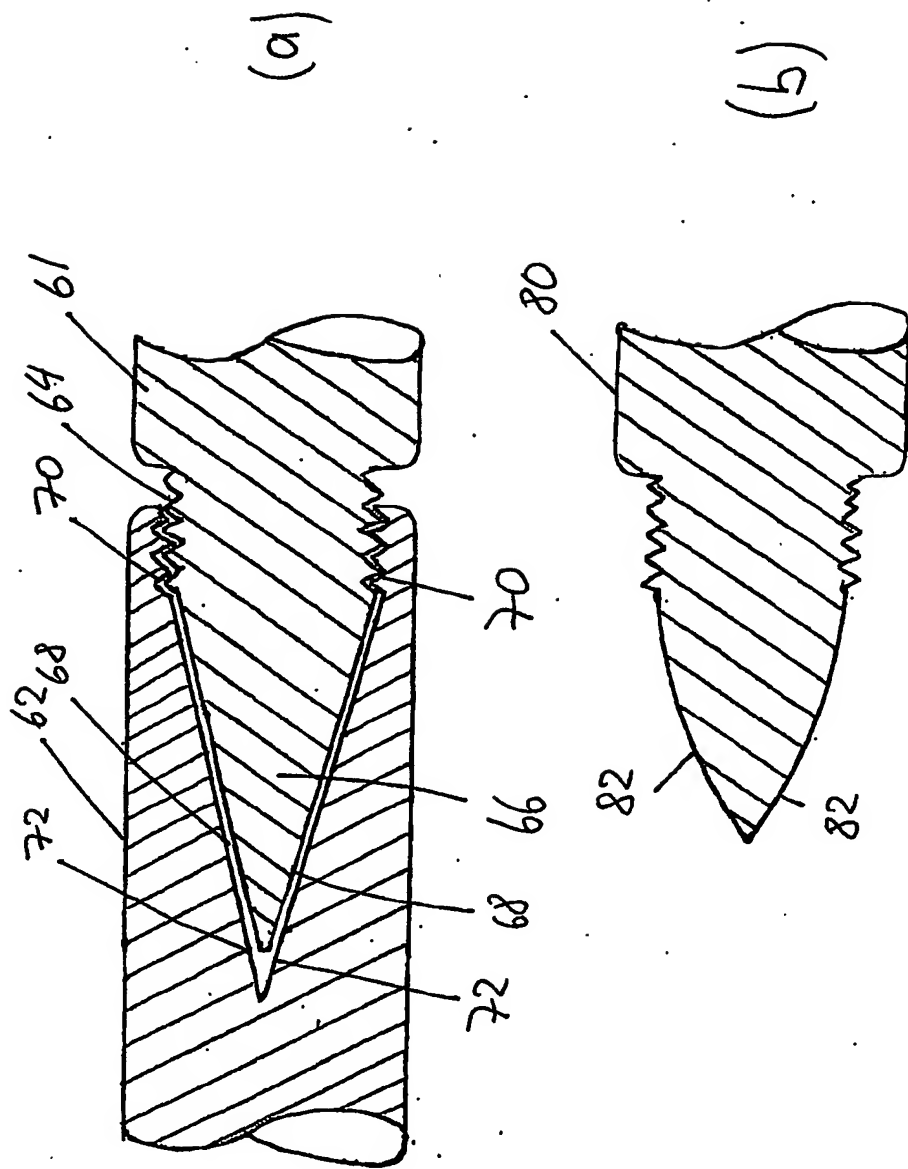


FIG. 6

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